Teachers and Curriculum

THE UNIVERSITY OF WAIKATO
Te Whare Wānanga o Waikato

KAIAKO ME TE MARAUTANGA

VOLUME 16, ISSUE 1, 2016

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ISSN 2382-0349

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Acknowledgement of Reviewers

Thank you to the reviewers for their contribution to the process and quality of this issue. Many thanks to those who also helped with a review but the paper did not make it to this issue. Papers in this issue were reviewed by the following people (in alphabetical order):

Judy Bailey, Jennifer Charteris, Bronwen Cowie Kerry Earl, Richard Edwards, Jenny Ferrier-Kerr, Linda Hogg, Yvonne Kuys, Michele Morrison, Darren Powell, Merilyn Taylor, Bill Ussher, Cheri Waititi, Sandra Williamson-Leadley

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EXPANDING STUDENTS' PERCEPTIONS OF SCIENTISTS THROUGH THE DRAMATIC TECHNIQUE OF ROLE ON THE WALL

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Abstract

This paper highlights the use of a drama convention—'Role on the Wall'—to teach the Nature of Science (NOS) in a Year 7/8 classroom.

Students were positioned as 'expert' scientists re-investigating the science behind the sinking of the Wahine in a Mantle of the Expert unit. Students drew a 'Role on the Wall' of a scientist. The inner body portion outlined characteristics they thought scientists have and in the outer portion they listed the tasks scientists do. This approach can support the teaching of NOS, as it provides opportunities for students to collaboratively construct understandings about scientists and their activities. Differences were noted between the visual language and the oral language used to describe scientists. Shifts in student understanding about scientists were also examined in relation to student comment from classroom discussion and student interviews.

Keywords

Nature of Science; Mantle of the Expert; 'Role on the Wall'; drama, science education.

Introduction

There is wide acknowledgement that it is important for students to understand the Nature of Science (NOS) (Hipkins, 2012; Lederman, Abd-El-Khalick, Bell, & Schwartz, 2002). In the *New Zealand Curriculum* (NZC) (Ministry of Education, 2007b), the NOS is the "overarching, unifying strand. Through it students learn what science is and how scientists work" (p. 28). It is divided into four sub-strands, 'Investigating in science', 'Communicating in science' and 'Participating and contributing' and 'Understanding about science'. In the 'Understanding about science' sub-strand students explore how "the work of scientists interacts with society" (Ministry of Education, 2007c, Achievement aims, Nature of science).

While students realise that science is valuable to society (Tytler, Osborne, Williams, Tytler, & Cripps Clark, 2008), few students aspire to become scientists (Bennett & Hogarth, 2009; DeWitt & Archer, 2015). One reason is the negative discourse surrounding the construct of 'scientist' (Bennett & Hogarth, 2009). This negative positioning is seen in images of scientists as unkempt bespectacled males working alone in laboratories (Mead & Metraux, 1957; Narayan, Park, Peker, & Suh, 2013). Two strategies are recommended to offset this discourse. The first is to promote scientists as normal rather than nerdy or brainy (DeWitt, Archer, & Osborne, 2013, p. 1473). The second is to ensure that students and their families receive accurate information about the advantages of studying science, and the wide range of science careers available (DeWitt & Archer, 2015, p. 2185; DeWitt et al., 2013, p. 1472).

Many teachers find the NOS difficult to understand and teach. Hipkins (2012) suggests teachers need support to understand the NOS, and resources and strategies to implement it in their teaching (p. 18). Useful approaches include: situating learning in real life contexts (Wong, Hodson, Kwan, & Yung, 2008), teaching in an explicit but reflective manner (Abd-El-Khalick & Lederman, 2000, p. 691), and providing resources (Hipkins, 2012). Drama has also been identified as useful in enhancing students'

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ISSN: 2382-0349
Pages 89–95

understandings of the NOS (Boujaoude, Sowwan, & Abd-El-Khalick, 2005; McGregor, Anderson, Baskerville, & Gain, 2014).

This paper discusses the use of the drama convention—'Role on the Wall'—to enhance students' understanding about the NOS and to promote a realistic but positive image of scientists. In the New Zealand context, drama conventions are described in the *Arts online: Drama: Glossary* as "established ways of working in drama (for example, hot seating, role on the wall, freeze-frame images) that explore meaning or deepen understanding; or established practices in theatre (for example, the soliloquy, aside)" (Ministry of Education, 2007a). According to Neelands and Goode (2000), the drama convention 'Role on the Wall' is used to build a visual collective understanding of the character being studied.

In 'Role on the Wall', an outline of the character is drawn (see Figure 1) and students build a visual representation of the character, identifying internal and external characteristics. For example, if students were characterising Little Red Riding Hood, they might put 'adventurous' in the internal characteristics, and 'wears a red hood' in the external characteristics.

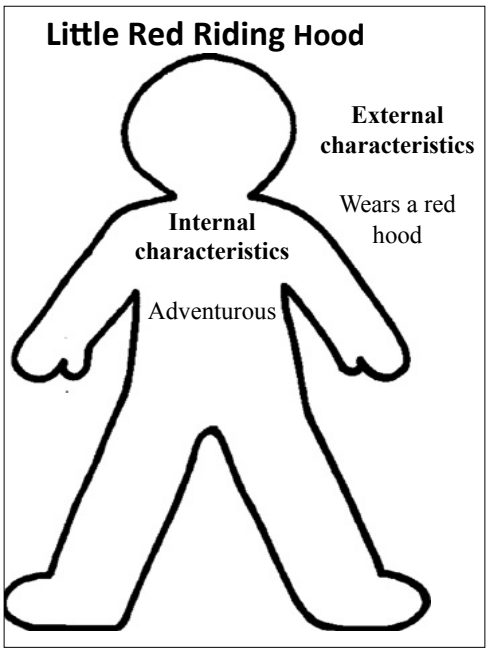

Figure 1: Example of a 'Role on the Wall'

Classically 'Role on the Wall' is used to aid student characterisation in drama (Baskerville & Anderson, 2015; Neelands & Goode, 2000). It has been used to deepen students' understandings of curricular subjects (Houseal, Ray, & Teitelbaum, 2013), such as writing (Baldwin & John, 2012), and to explore identity (Hatton, 2013; Houseal et al., 2013).'Role on the Wall' can also be used to collect data (Houseal et al., 2013).

Methodology

This paper looks at one aspect of an action research (Wells, 2009) study into the benefits and constraints of using the drama-based pedagogy Mantle of the Expert (Heathcote & Bolton, 1995) to teach science to Year 7/8 students—'Role on the Wall'. The study occurred between July and October 2011, for two afternoons a week, in a semi-rural New Zealand school. The participants were a second year teacher Jayne (pseudonym), and 27 Year 7/8 students (aged between 11–13).[i] I acted as a Participant-as-Observer (Cohen, Manion, & Morrison, 2011) and co-taught the science-based Mantle of the Expert unit with the classroom teacher. Data was generated from student assessments, student

[i] Depending on the wishes of the students and their parents, the students were either identified by their first names or pseudonyms

and teacher interviews, classroom observations, a reflective blog and the collection of classroom artefacts.

Mantle of the Expert (Heathcote & Bolton, 1995) is a drama-based pedagogical approach. Students agree to take on fictional roles as a company of 'experts' and work within a fictional context. They learn curricular content through carrying out a commission from a fictional client. In this study, students were positioned as 'expert' scientists, commissioned to re-investigate the science behind the sinking of the Wahine in Wellington Harbour, New Zealand, in 1968. In addition, working in role provides participants with an opportunity to understand someone else's life, and explore another identity without risk (Heathcote & Bolton, 1995).

As being a scientist was a crucial aspect of this study, students were asked about the tasks they do in the pre and post-unit assessments, and 'Role on the Wall' was used to stimulate student understandings of scientists (see Swanson, 2016, p. 236). Students were asked to draw an outline of a scientist and in the middle write down words describing the characteristics of scientists, and outside the outline write the tasks they do. The students worked in groups supported by teacher questioning.

In the early stages of the unit, belief was built in the drama, and the students' positioning as a company of expert scientists, by analysing the company notice board, making CVs/Resumes and 'Role on the Wall'. Once belief was built, students worked as expert scientists to learn about weather prediction, cyclones and buoyancy and stability as part of re-investigating the sinking of the Wahine using both experimentation and drama conventions. At the end of the unit, in role as expert scientists, they wrote a report to the client detailing the scientific reasons for the sinking, and providing evidence for their findings from the experiments they carried out.

Findings/analysis

This section details the findings on scientists generated from 'Role on the Wall' and links them to the student assessments and interview data.

An example of a 'Role on the Wall' artefact is given in Figure 2. The scientist in Figure 2 is a male with wacky hair, and 'Frankenstein' features, holding a foaming beaker. This was typical of the pictures drawn by the students. Four out of the five groups drew male scientists; most had wild hair; two wore lab coats; and two held beakers.

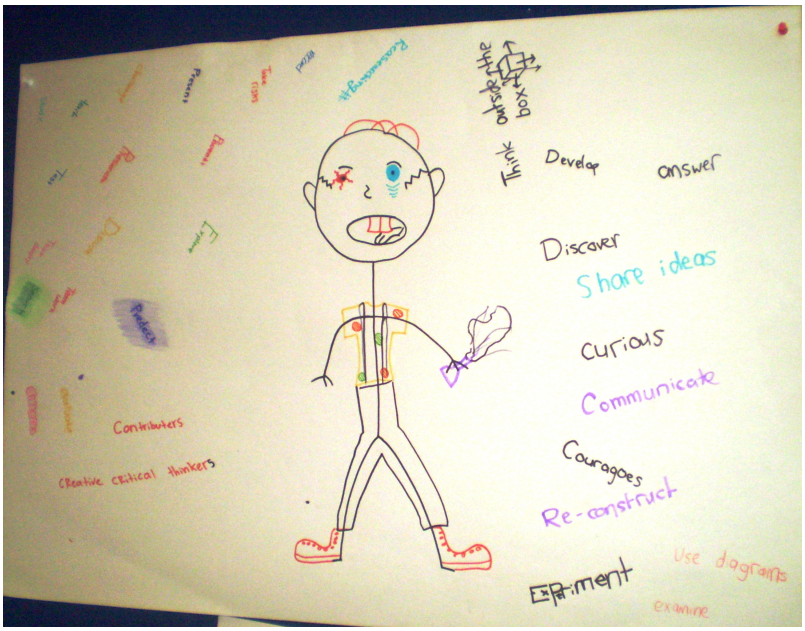

Figure 2: Example of a 'Role on the Wall' artifact

The students shared their understandings at a 'team meeting'. Some student answers are given to show the scope of the discussion. The students identified that scientists were, "curious—questioning evidence" and "observant and eager to explore stuff and find out the answer" (Episode Transcript (ET), 11/08/11). Shania thought scientists "well educated" while Tom stated they were "fun to be

with, creative [and] imaginative" (ET, 11/08/11). Bradley proposed that scientists "imagine the things that aren't possible and experiment with things that are" (ET, 11/08/11).

The students also mentioned scientists need to be critical thinkers and both test and communicate their knowledge. This was seen in them using such comments as "infer", "share", "debate and "question".

> Taylor: Infer … think beyond the first thing, like the meaning….
>
> Hamish: Share our knowledge and to test and combine and get other theories ….
>
> Alicia: Debate … Cause, kind of people might have other ideas and they might question what you are doing. (ET, 11/08/11)

This way of thinking was further developed in using the word 'courageous' to describe scientists, their actions and ideas.

> Liam: They think of scientific stuff and be courageous and think outside the box.
>
> Jayne: What does it mean to be courageous?
>
> Tom: Try new things.
>
> Shania: They might be courageous using dangerous chemicals. (ET, 11/08/11)

The discussion showed that the 'Role on the Wall' activity enabled the students to collectively form a sophisticated understanding of what a scientist is and does. These responses ranged from descriptions of simple tasks scientists do like 'observe' to performing complex scientific processes.

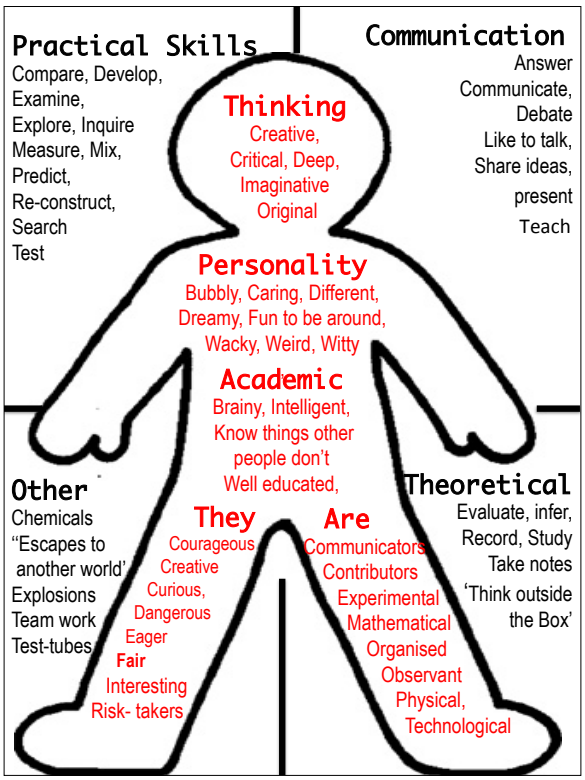

Figure 3: Graphic of 'Role on the Wall'. (Adapted from Positioned as expert scientists: Learning science through Mantle-of-the-Expert at Years 7/8, Figure 7.4, p. 241, by C. Swanson, 2016, Hamilton, New Zealand: The University of Waikato.)

The level of sophistication became more obvious when the student responses were coded, and combined into a new 'Role on the Wall' graphic (see Figure 3). Student statements from the interviews were divided into eight categories. Inside the outlined figure the category items were: Academic, Personality, Thinking, and (what) They are. Outside the outlined figure, the categories for what scientists do were: Practical skills, Communication, Theoretical and Other.

The outer statements revealed various aspects about the tasks scientists do. Most striking was the increased number of items in the Communication category; seven items compared to zero items in the pre-intervention assessment. Terms in the Theoretical section, such as 'infer', contained more complex theoretical concepts than in either the pre- or post-unit assessments. Generic Practical Skills used in science were mentioned, such as 'predict' and 'testing', similar to the pre-test. As in the pre-test, items in the Other section ranged from identifying science equipment, to 'explosions'.

The internal section of the figure in the 'Role on the Wall' activity looked at scientist characteristics. Students not only considered that scientists were 'deep' 'critical thinkers' but also 'creative' and 'imaginative'. The Personality comments range from 'caring', perhaps referring to careers situated in the health profession, to 'bubbly' and 'fun to be around'. Some students highlighted the 'wacky'/'weird' label. The Academic characteristic traits endorsed the impression from literature that scientists are 'brainy' and 'well educated'. The students stated that scientists possess analytical characteristics like 'mathematical' and 'organised'. They also recognised that scientists are 'risk-takers', 'curious' and 'courageous'. They considered science was sometimes 'dangerous' and that it was important for scientists to be both 'communicators' and 'contributors' to society. It can be seen that the students created a sophisticated collective understanding about who a scientist is and what they do through developing the 'Role-on-the-Wall' of a scientist. Through discussion, they then deepened and explained their initial ideas to include aspects such as being creative as part of scientists' work.

Students were asked about their impressions of scientists in their interviews.

> Taylor: When I was little, (last year—giggle), I just thought of science as a whole lot of chemicals and people with glasses.
>
> Cameron: When you are younger you always think of scientists as nutty professors creating dinosaurs in their dungeon … But then we grow to 11,12,13 and you start to realise that when you do stuff like this, it is more than just walking around with a lab coat and clipboards and taking notes and things (C&T, 05/10/11).

Their comments highlighted that they had previously thought scientists were 'nutty' people who worked in isolation in a 'dungeon' with 'chemicals', and wore 'glasses'. However, this construct of scientists appear to shift over the duration of the unit. Taylor relegated the weird scientist concept to 'last year'. Cameron's perception evolved from a 'nutty professor' to scientists with 'a lab coat and clipboards and taking notes' to 'doing stuff like this' [what we did in our investigations in class]. He no longer equated scientists as unthinkable others but someone like us.

Discussion

Student drawings of scientists were similar to that of Mead and Metraux (1957) and Narayan et al. (2013) where students depicted scientists as unkempt bespectacled males working alone in laboratories. Students' comments revealed that they had previously thought scientists were 'nutty professors' but had broadened their perceptions to scientists being more like us rather than weird (DeWitt et al., 2013).

The 'Role on the Wall' activity provided space for students to construct meaning about scientists and the roles they carry out. Students linked scientists' practical skills with the theoretical knowledge required, and with the communicative aspect of being a scientist. They described aspects of personalities and broad disciplinary characteristics of scientists. Reflecting critically and sharing their work orally in role seemed to enable the students to draw deeper conclusions, like scientists needing to debate their work.

Although a few students positioned scientists as 'weird', most comments were positive, positioning scientists as 'interesting', 'fun', 'creative', and 'imaginative'. This contrasts with the students in Bennett and Hogarth's (2009) study who described scientists as 'weird' and 'unfeeling'. Positioning scientists positively and illuminating the 'caring', 'contributing' and 'creative' aspects of being a scientist may highlight the humanitarian value of science to society (Tytler et al., 2008) and also make a career in science inviting to students (DeWitt et al., 2013; Tytler et al., 2008).

'Role on the Wall' can be seen to be a useful resource (Hipkins, 2012) through which to teach the 'Understanding of science' aspect of NOS. While 'Role on the Wall' did not explicitly teach the NOS as recommended in the literature (Abd-El-Khalick & Lederman, 2000), it did illuminate students' current understandings for the teacher. It gave the students space to reflect (Abd-El-Khalick & Lederman, 2000) on the characteristics of scientists and extrapolate why scientists, for example, need to 'debate' their findings or be 'courageous', and to construct a shared understanding of scientists. Situating the 'Role on the Wall' activity within the larger constructed drama enabled students to work within a real-life context, that of re-investigating the sinking of the Wahine, which Wong et al. (2008) advocate as important. In addition, it confirmed that drama can be a useful way to teach the NOS (Boujaoude et al., 2005; McGregor et al., 2014) and highlights the value of using 'Role on the Wall'.

Recommendations

'Role on the Wall' widened students' understanding about scientists and the tasks they do. It could be a useful addition to the classroom teacher's toolkit for promoting the NOS, and positive images of scientists and science careers.

'Role on the Wall' could be used to research prominent scientists, or to build an understanding of characters/stakeholders when exploring socio-scientific issues. A similar technique could be used to explore science concepts. For example, in buoyancy, students could draw a boat and write on the inside of the boat what they know about why it floats and outside the boat, what they want to find out. 'Role on the Wall' could also be used explore perceptions and discourses in other curricular areas.

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